

RECEIVED

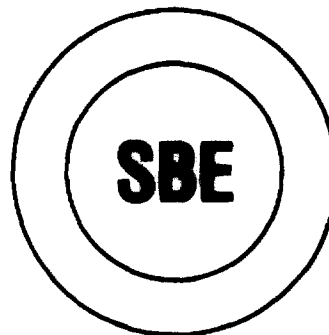
DOCKET FILE COPY ORIGINAL

APR 1 1996

**FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY**

**Comments of the
Society of Broadcast Engineers, Inc.**

**ET Docket 96-2
Radio Astronomy
Coordination Zone
for Puerto Rico**



April 1, 1996

©1996 SBE, Inc. All rights reserved.

No. of Copies rec'd 04
List ABCDE

SOCIETY OF BROADCAST ENGINEERS, INC.
Indianapolis, Indiana

RECEIVED

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

APR 1 1996

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

In the Matter of

Amendment of the Commission's
Rules to Establish a Radio Astronomy
Coordination Zone in Puerto Rico

ET Docket No. 96-2

To: The Commission

Comments of the Society of Broadcast Engineers, Inc.

The Society of Broadcast Engineers, Incorporated (SBE), the national association of broadcast engineers and technical communications professionals, with more than 5,000 members in the United States, hereby respectfully submits its comments in the above-captioned Notice of Proposed Rule Making (NPRM) relating to establishing a radio astronomy coordination zone in the Commonwealth of Puerto Rico.

I. SBE Supports Need for Arecibo Radio Astronomy Coordination Zone

1. SBE is not unsympathetic to the needs of the Arecibo Observatory to control radio noise and out-of-band harmful emissions that could interference with, or degrade the effectiveness of, its radio astronomy mission. As a commentator to the initial Cornell University (Cornell) Petition for Rule Making (RM-8165), SBE is gratified to see that virtually all of its objections to Cornell's initially proposed protection protocols have been rectified in this NPRM. SBE is also pleased to see that Cornell disclaims any intent to obtain veto power over other radio services operating in Puerto Rico, or to create a Quiet Zone in Puerto Rico,¹ and that Cornell does not desire to deny any radio service the right to broadcast or to serve the public.² Largely as a result of these assurances by Cornell SBE does not now oppose this instant rule making.

¹ NPRM, at Paragraph 5, and again at Paragraph 16.

² NPRM, at Paragraph 7.

II. Clarification of Shadowing Claim

2. Before getting into the heart of its comments, SBE would like to correct a claim made at Paragraph 4 of the NPRM, namely that the Arecibo Observatory has “nearly direct line-of-sight to 70% of the island territory of Puerto Rico and the neighboring Island areas.” SBE is not sure what Cornell means by the term “nearly direct line-of-sight.” Either line-of-sight exists or it does not.

3. In its original November 30, 1992, filing, Cornell described the Arecibo Observatory as being located at 18.346° N by 66.753° W, or 18° 20' 46" N, 66° 45' 12" W. SBE notes that these coordinates do plot to the very center of the Arecibo Observatory, located on the Bayaney, PR, 1:20,000 scale topographic map. That map further shows the ground elevation of the center of the dish to be 230 m AMSL. Cornell further describes the 600 ton reflector platform as being 450 feet (137 meters) above the reflector surface. Therefore, a center-of-radiation height of 367 meters AMSL can be deduced for the active receiving portion of the Arecibo Observatory.

4. As shown by the attached Figure 1, the Arecibo Observatory is located in the southwest corner of the Arecibo Barrio of Puerto Rico. For this site, the attached Figure 2 shows those areas with and without line-of-sight, based on 4/3 effective earth radius, 3-second digitized terrain data, and a receiver height of 9.1 meters (30 feet) AGL. Computer analysis of the non-shadowed area shows that it represents only 9.5% of the 90,792 square kilometer Puerto Rico land area. Thus, the Cornell claim that the Arecibo Observatory has “near line-of-sight” to 70% of the island is wildly incorrect; the correct figure is less than 10%. Nevertheless, SBE does not object to the NPRM proposal that a Coordination Zone be established.

III. SBE Has No Objection to a Notification Requirement

5. SBE has no objection to the proposed requirement that applicants for fixed stations in Puerto Rico be required to submit a copy of the relevant technical portions of applications to the Observatory, at the same time the application is filed with the Commission. SBE agrees that this is a small burden for applicants to bear, given the 20-day maximum period that the Observatory would have to review the application and raise any interference concerns it might have. This would ensure that the Observatory’s review would be unlikely to delay processing at the FCC, as FCC processing generally takes longer than 20 days. SBE objects to any requirement to make application details available to the Observatory prior to the filing

SBE Comments: ET Docket 96-2

of the application with the Commission. As the Commission notes at Paragraph 22 of the NPRM, this would require applicants to divulge, in advance of filing, information which they may wish to keep confidential until the application is filed.

IV. SBE Urges the Commission to Define the Term "Reasonable Efforts"

6. At Paragraph 19, the NPRM states:

"Further, we are not proposing to require that the applicants bear the costs of interference avoidance which exceed those incurred through reasonable efforts to accommodate the Observatory."

SBE believes that the Commission needs to define the term "reasonable efforts." SBE suggests that any modifications requested by the Observatory that would not increase the applicant's cost, or delay the applicant's project, be considered as "reasonable efforts." Conversely, any modifications requested by the Observatory that would increase the applicant's cost, or delay the applicant's project, should be excluded from the "reasonable efforts" definition. In the case where modifications requested by the Observatory would not delay an applicant's project, but would increase the project costs, SBE recommends that such modifications be considered as "reasonable" if the Observatory agrees to reimburse the applicant for all such additional costs.

7. Without the above "reasonable efforts" definition, SBE is concerned that the Observatory might be too liberal in its characterization of "reasonable effort" modifications to provide, for example, more out of band suppression than required by the FCC Rules. It is the party who must pay the costs of requested modifications that should be allowed to decide what constitutes "reasonable efforts."

V. SBE Urges Commission to Establish Maximum Signal Level Standards

8. SBE disagrees with the proposal *not* to establish specific interference standards that would be deemed as acceptable at the reference coordinates for the Arecibo Observatory. The reason for this is that otherwise broadcast engineers would be in the unenviable position of trying to hit a "moving target." Applicants cannot be reasonably expected to protect the Arecibo Observatory at their early (and often highly confidential) design stages if the Observatory won't tell them what are, and are not, acceptable field strengths for fundamental and harmonic frequencies at the Arecibo Observatory.

9. However, such standards need not necessarily be permanently embedded in the FCC Rules. As an alternative, guidelines could be published by the Arecibo Observatory to

SBE Comments: ET Docket 96-2

provide information regarding the level of protection that the Observatory desires and believes to be reasonable. Since these would be guidelines rather than statutory rules, there would remain flexibility for both sides to still treat potential interference on a case-by-case basis, and for broadcasters to appeal the matter to the Commission, in the event complying with the guideline would represent an unreasonable burden on the ability of a broadcaster to fulfill its obligation to provide service to its community of license or upon its right to build the best possible facilities otherwise consistent with the FCC Rules.

10. Paragraph 5 of the NPRM indicates that parameters that Cornell believes could be modified to resolve interference conflicts include power reduction, site relocation, and directionalization. SBE agrees that these are all effective interference avoidance tools, but are generally only practical if applied at the early stages of a project. Once a project has matured to the FCC application stage, changes in power level, site, or antenna pattern are almost assured to increase the project's cost and add substantial delay to the project, either of which the SBE submits fall into the "unreasonable" category. Thus, if Cornell expects these interference-avoiding tools to be used, broadcasters and other applicants must be able to bring them to bear at the early, and often confidential, stages of a project. This means that Cornell must be willing to establish field strength levels at the Observatory's reference coordinates, below which applicants can be assured that the Arecibo Observatory will not object.

11. This should not be construed as conceding that the Arecibo Observatory is entitled to more interference protection than that specified in the FCC Rules. Rather, it should be interpreted as meaning that if broadcasters, and other applicants, could know in advance whether supplemental hardware, such as filters to suppress, for example, the 13th through 16th order harmonics of FM broadcast stations to beyond the -80 dBc level specified in the FCC Rules, might be necessary in order to meet a field strength limit in the 1,400-MHz neutral hydrogen band, design engineers could then allow for the slight additional insertion loss of such filters at the fundamental frequency, and allow for more space to install such filters, on the assumption that the Arecibo Observatory would agree to reimburse the applicant for the cost of the extra filter. The extra space and insertion loss of such a filter would likely come within the "reasonable efforts" definition, but only if allowed for in the early stages of a design.

12. Broadcasters, and other applicants, would also know in advance the levels for which their authorized fundamental emissions could be expected not to cause brute-force overload

to the sometimes exquisitely sensitive equipment used by radio astronomy observatories. If the maximum desirable in-band signal levels are known in advance, design engineers might be able to substitute a different site, perhaps with dramatically lower fundamental signal levels at the Arecibo Observatory, for a site that otherwise would have been selected absent consideration of the Arecibo Observatory's needs. The key is knowing in advance the levels that the Arecibo Observatory would, and would not, consider to be a "problem."

13. If instead Cornell feels it cannot commit to published interference levels, then it must be prepared to reimburse significant costs to an applicant who might then be asked to modify its application to provide the Observatory with more protection than that required by the FCC Rules. And even where the Arecibo Observatory is willing to bear such costs, such mitigation measures may still be unreasonable because of the time delay they would inevitably cause.

V. Calculation Methodology

14. For purposes of calculations to determine the predicted signal level at the reference coordinates and height for the Arecibo Observatory, SBE urges that, where terrain obstruction would exist, alternative propagation models such as the Terrain Integrated Rough Earth Model (TIREM) model³ be acceptable for demonstrating compliance with a specified

³ The TIREM (Terrain Integrated Rough Earth Model) algorithm was developed at the Electromagnetic Compatibility Analysis Center (ECAC) in Annapolis, Maryland. TIREM uses detailed terrain profiles to compute values of basic transmission loss from point to point. The model evaluates the profile between two sites and, based on the geometry of the profile, selects the most probable mode of propagation. TIREM is applicable to problems between 40 MHz and 20 GHz. The sub-modules of TIREM include various knife-edge models, a rough-earth diffraction model, and line-of-sight models. The sub-modules are selected automatically by the system, as appropriate for each point being calculated, to take into account variations such as single and multiple knife edges, marginal Fresnel-zone clearance, and line of sight with various degrees of clearance. The TIREM model is the most accurate available means of predicting signal strength when details of terrain along the propagation path are known.

In 1983, the U.S. Department of Commerce released a "Master Propagation System Users' Manual," Code PB83-178624, based on work by the National Telecommunications and Information Administration (NTIA), Annapolis, Maryland. This manual provides information on the TIREM method for prediction of radio propagation. Most of the propagation models used by TIREM were taken from the earlier Technical Note 101, "Transmission Loss Predictions for Tropospheric Communications Circuits," also released by the U.S. Department of Commerce. The main difference is that TIREM computes a single result for propagation loss to each point based upon computer selection of the best model; the results from TIREM are therefore unbiased, in contrast to those obtained from Technical Note 101, which is essentially a cookbook from which various path-loss recipes can be taken. Technical Note 101 results therefore depend heavily on the judgment of the engineer using those 1966 methods.

TIREM computes the median basic transmission loss in two steps. First, the terrain profile is examined by the computer and an initial mode of propagation is selected based on the path geometry. The model then branches to the appropriate subroutines that actually compute the loss. The parameter extractor processes the terrain profile to derive the information needed for the initial mode selection. These parameters include radio horizon distances, effective antenna heights, and path angular distances. Refractive effects of the earth's atmosphere are accounted for

SBE Comments: ET Docket 96-2

signal level, in the event maximum levels are specified, and in the event broadcasters wish to make such calculations in the early design stages of a project, long before technical details are made a matter of public record by the filing of an application.

VI. Summary

15. SBE is sympathetic to the needs of the Arecibo Observatory. So long as the term "reasonable effort" is defined as suggested in these comments, SBE has no objection to the Coordination Zone proposed in this rule making. SBE believes that the Arecibo Observatory would be wise to establish maximum levels that it would consider to not be a problem at the reference coordinates for the Observatory, as SBE believes this would allow the Observatory to achieve its goals in the most cost effective manner possible.

by using an effective earth radius at heights below 1,000 meters and the Central Radio Propagation Laboratory exponential reference atmosphere at greater heights. Using the radio horizon distances calculated by the parameter extractor, the initial mode selection is made based on whether the given path is within the horizon or beyond it. The final determination of propagation mode is based on a number of parameters such as Fresnel clearance. There are nine different propagation modes considered by TIREM.

SBE Comments: ET Docket 96-2

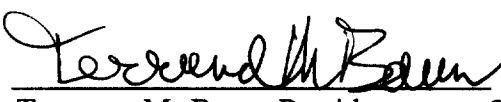
List of Figures


16. The following figures or exhibits have been prepared as a part of these ET Docket 96-2 comments:

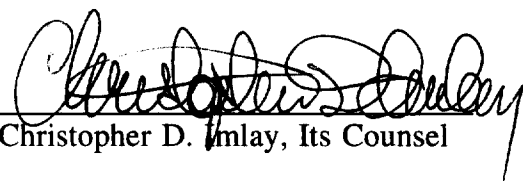
1. Map showing location of Arecibo Observatory
2. Map showing portions of Puerto Rico with line-of-sight to the Arecibo Observatory.

Respectfully submitted,

Society of Broadcast Engineers, Inc.

By 
Terrence M. Baun, President

By 
Dane E. Ericksen, P.E., CSRE, CSTE
Chairman, SBE FCC Liaison Committee

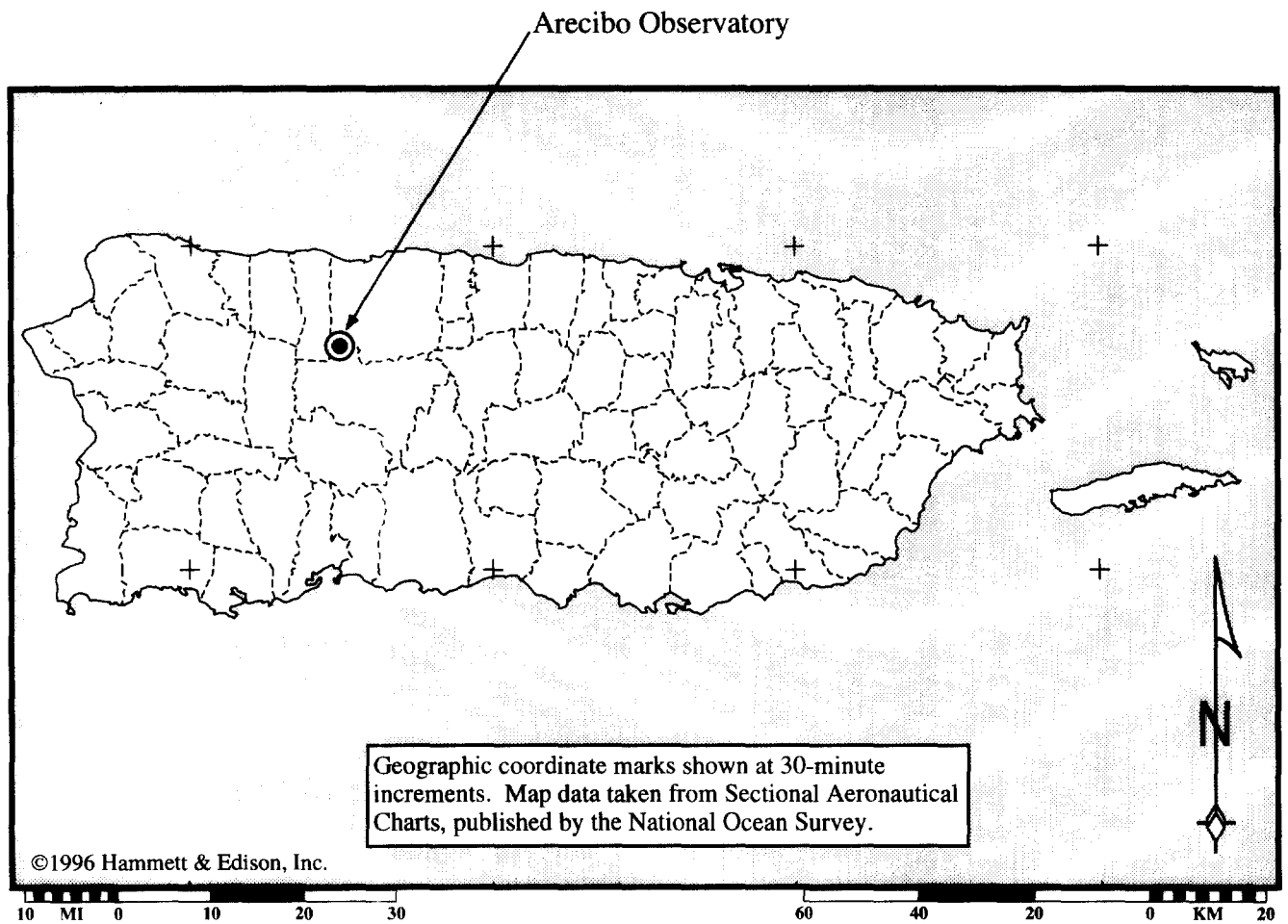
By 
Christopher D. Imlay, Its Counsel

April 1, 1996

Booth, Freret & Imlay
1233 20th Street, Suite 204
Washington, D.C. 20036
202/296-9100

SBE Comments to ET Docket 96-2

Location of Arecibo Observatory



Society of Broadcast Engineers, Inc.
Indianapolis, Indiana

960219
Figure 1

SBE Comments to ET Docket 96-2

Portions of Puerto Rico with Line-of-Sight to Arecibo Observatory

